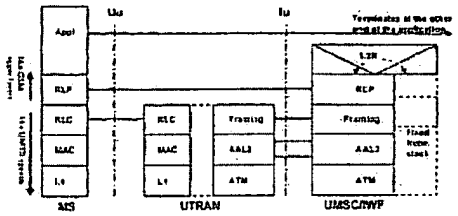
UMTS CIRCUIT SWITCHED DATA USER PLANE

Patent number: JP2003508940 (T)
Publication date: 2003-03-04
Inventor(s):
Applicant(s):
Classification:
- international: ***H04L12/66; H04L29/06; H04L29/10; H04Q11/04; H04W92/02;*** *H04L12/56;* **H04L12/66; H04L29/06; H04L29/10; H04Q11/04; H04W92/00;** H04L12/56; (IPC1-7): H04L12/66; H04L29/10; H04Q7/38
- european: H04W92/02; H04L29/06; H04Q7/22S3; H04Q11/04S2
Application number: JP20010502291T 20000608
Priority number(s): NO19990002788 19990608; WO2000SE01170 20000608

Also published as:
JP3727020 (B2)
WO0076138 (A1)
ZA200108997 (A)
NO992788 (A)
EP1183829 (A1)
more >>

Abstract not available for JP 2003508940 (T)
Abstract of correspondent: **WO 0076138 (A1)**

The present invention relates to a method which permits circuit switched data communication equipment to be used in an access network like UTMS in an efficient way. The solution is based on the use of the upper layers from GSM together with the transport layers for UTMS speech.



UMTS CIRCUIT SWITCHED DATA USER PLANE

Description of correspondent: **WO 0076138 (A1)**

UMTS CIRCUIT SWITCHED DATA USER PLANE Technical field
The present invention relates to mobile telecommunication, and in particular use of older circuit switched data communication equipment in the new access networks that are under development.

Technical background
The problem area
GSM and other digital mobile systems have specific solutions for transporting circuit switched data towards the fixed network through their access network.

A new terrestrial radio access network is constructed for the third mobile generation by 3GPP called UMTS. This access network does not have any defined way of handling circuit switched data.

However, there is still a huge amount of circuit switched data communication equipment installed in the fixed network, and people will like to be able to connect via the new access network technology.

Known solutions
Fig 1 shows the network scenario with a mobile terminal communication through UTMS towards circuit switched data communication equipment installed in the PSTN/ISDN. At the present state of the art, circuit switched calls can be supported in the access networks either by a solution using packet data access or speech transport mechanisms.

Packet data access
One of the main intentions of the new mobile system is data access. Optimised IP access (Packet access) has been one of the key drivers when developing the improved air interface solution. A user plane protocol stack ensuring the transmission has been created.

The packet access user plane protocol stack is not very optimised for full duplex links with constant bit rate. It has a lot of overhead that is not needed or beneficial for circuit switched connections. The packet access stack is also optimised for handling burst traffic while it is natural to have more constant payload for mobile circuit switched data access.

The packet access stack could be used also for circuit switched connections, but in addition to the abovementioned disadvantages it would be tricky to support hand over to GSM circuit switched data calls.

Speech
Speech is also an important service and a solution for ensuring the transport capabilities needed for that, typical low delay and constant bit rate have been specified.

The speech solution has nice transport capabilities for circuit switched calls, but no reliable data transport. The transport have as little delay as possible and are using
ATM AAL2 which is optimised for supporting fixed bit rate connections below 64 kbit/s.

If data would be transported in the same way as speech, one would relay on end-to-end fixing of bit errors over the air interface. The protocols supported in fixed network equipment are designed for physical cables, and are not very efficient when used over the air interface which have a lot of interference and very unstable nature compared with wires.

Summary of the invention
The invention has as its object to provide a method for communication in the new access networks which permits use of older circuit switched communication equipment without the drawbacks associated with the known methods as mentioned above.

In particular the present invention relates to a method for communication in an UTRAN, comprising a mobile terminal working towards a Mobile Switch Centre with an Interworking
Function (IWF). According to the said method circuit switched data are transported in the upper layers from GSM which uses the protocols RLP and L2R, on the transport layers for UTMS speech.

The invention also relates to a system for communication between a terminal in a wireless access network and a fixed network which uses said method.

Further embodiments of the invention will appear from the appended patent claims.

Brief description of the drawings
The invention will now be described in detail in reference to the appended drawings in which:
Fig. 1 provides a system overview,
Fig. 2 indicates the main protocols and data transport specifications and where they apply in a system according to the invention
Fig. 3 illustrates the stack according to the present invention using GSM-like upper layer protocols and UMTS speech lower layer protocols.

Description of embodiments
Fig. 1 gives a system overview showing a mobile terminal on the left hand side. UTRAN (UMTS Terrestial Radio Access Network) designates the radio network in which the mobile terminal is communicating trough the Uu interface. UTRAN is the radio part of the UMTS system, while PLMN (Public Land
Mobile Network) is the core network behind the UMTS system, i. e. the hardware architecture of switches etc.

supporting the UTRAN. The UTRAN is"talking"to the PLMN trough the Iu interface. The UMTS network is connected to the common
Public Switched Telephone Network, with its terminals shown on the right hand side.

The basis of this invention is to utilise the upper layers from GSM together with the transport layers for UMTS speech.

In the further discussion reference is made to Fig. 2 which illustrates the main protocols and data transport mechanisms and how they are arranged in a system according to the present invention. The lower layers are utilised by more services, while the upper layers are specific for circuit switched data communication.

The system contains four major parts in the solution, which will be discussed in detail below.

The user equipment
This is the physical equipment that the end user will use to communicate over the radio interface. It can, and probably will, be a lot of very different types of equipment. From physical fax machines connected to UMTS mobile phones too integrated devices for video transmission. For this solution it is unimportant whether the user equipment contains one or several physical boxes.

The user equipment will need to run the RLP over RLC. (See the protocol chapter for further description.)
The UTRAN.

This is, like the abbreviation states, the UMTS terrestrial radio access network. The UTRAN has a lot of functionality for handling the radio access. It takes care of the physical air interface, and also takes care of the handovers between different base stations within one UTRAN. One important task of UTRAN related to this invention is the conversion of the actual radio protocols (LI, MAC and RLC) into the Iu protocols (AAL2 and ATM). This conversion is specified for speech, and this invention utilises it. Any speech specific header information added in the Iu framing should be optional and not transported.. Only minor header information is needed containing information like current transport status.

The UMTS MSC.

This node will handle the call control and mobility management for all circuit switched calls. This functionality is of course also needed for circuit switched data calls. The important task of the UMTS MSC for this invention is the interworking functionality, which is called IWF. The IWF does a conversion between the Iu protocols and the protocols towards the fixed network (see figure 1). In GSM this is a conversion of the GSM V. 110 and
GSM ATRAU protocols on layer 1 and RLP on top for nontransparent calls to ISDN V. 110 and modem protocols (LAPM,
V. 34 etc.) on the fixed network side.

The Server.

At the other end, within the fixed network, is the server.

This does not necessarily need to be a server. The term refers to all equipment that you would normally connect to like Access Servers, Corporate servers and local modems. In
GSM this could also be another mobile, because the IWF functionality would make this invisible for the user equipment. It is an important aspect of the invention that the server does not notice anything about what is happening within UMTS. This is similar to a GSM circuit switched data call.

The Protocol Stack
Fig. 3 shows a protocol stack that visualises the solution:
This solution utilises the GSM non-transparent protocols
RLP and L2R for ensuring no faults in the user data transmitted. The RLP frames uses the GSM 14.4 RLP format because it introduces less overhead.

The solution utilises the UMTS speech protocols (ATM
AAL2) for the lower layer unsecured transport.

The user equipment will map the RLP frames to and from the
RLC layer.

The function in UTRAN that does a mapping of speech from
RLC to the Iu framing over AAL2, needs some small adjustments to transport the circuit switched data in the same way. The adjustment is to handle the Iu framing header also for data calls.

The IWF needs to place the RLP frames into the Iu framing.

No rate adaptation is needed for the transport. This is because of the capabilities of AAL2 [1.363.2].

The protocols involved
Reference is again made to Fig. 2 which gives an overview of where the different protocols and specifications apply.

We will now give a more detailed discussion of each protocol/layer involved in the inventive method.

Layer 2 RELay (L2R)
Main purpose of L2R is to provide a flow-control mechanism.

This is needed to support non-transparent bearer services.

The details of the particular L2R function for the different non transparent bearer services are contained in the

appropriate GSM 07-series Specification. See ref.. [11, [2] and [3]
The Layer 2 Relay (L2R) function provides for the reliable transportation of known, i. e. non transparent, user protocols across the radio interface of a GSM PLMN. The L2R functions are located in the Mobile Termination (MT) and the Interworking Function (IWF) associated with a Mobile
Switching Centre (MSC). The L2R uses the services provided by the Radio Link Protocol (RLP) to transport the non transparent protocol information between the MS and the
IWF.

Radio Link Protocol (RLP)
The main purpose of RLP is to provide a secure and errorfree data transport between the mobile station and the IWF.

The Radio Link Protocol (RLP) is specified for data transmission over the GSM PLMN. (see ref. [4]) It is based on ideas from other specifications such X. 25 and Q. 92x (LAP-B and LAP-D of CCITT, respectively.)
It includes several possibilities to invoke retransmissions if the payload is erroneous. RLP has been tailored to the special needs of digital radio transmission and is intended for use with non-transparent data-transfer.

Radio Link Control Protocol (RLC)
RLC is defined for the radio interface (Uu) in UMTS. Its main purpose is to ensure transfer of user data over this interface. RLC functions are located in the Mobile Station (MS) and the Radio Access Network (UTRAN). It has the following different modes: * transparent mode * unacknowledged mode * acknowledged mode
The modes offer services with different characteristics to the layers above. The transparent mode provides low delay but rather high error rates. The unacknowledged mode is similar to transparent mode but have some additional functions, but it does not include support for retransmissions.

The acknowledge mode, however support retransmissions and provides an error-free service. It has higher delay than the other modes. The actual delay will depend on the radio conditions.

For more details see [5]
Atm Adaptation Layer type 2 (AAL 2)
AAL 2 is a way to transport data on ATM. Compared to other
ATM adaptation layers it is most effective for rather small packets. As can be seen from the figure it is goes between UTRAN and the Core Network.

AAL 2 consists of the two parts, the common part and the service specific part.

The common part is specified by recommendation 1.363.2 (see ref. [6]). The AAL type 2 provides for the bandwidthefficient transmission of low-rate, short, and variable length packets in delay sensitive applications. More than one AAL type 2 user information stream can be supported on a single ATM connection.

Recommendation 1.366.1 (see ref. [7]), specifies the
Segmentation and Reassembly Service Specific Convergence
Sublayer of the ATM Adaptation Layer (AAL) type 2. On one or more AAL type 2 user information streams, the
Segmentation and Reassemble Service Specific Convergence
Sublayer may be deployed. The sublayer structure, and the procedures for the segmentation and reassembly process, as well as the optional transmission error detection and assured data transfer are defined in depth.

Advantages Hand over towards 2nd generation GSM can easily be handled since this already is defined at the RLP layer.

Utilises a lot of existing, proven, functionality. Both the higher layer functionality like compression and flow control and the lower layer functionality like ATM VCs.

The end user can keep his circuit switched datacom equipment and applications on the server (fixed network) side unmodified.

* The radio network transport capabilities are well suited for circuit switched connections.

Abbreviations
Like most modern areas, the telecom world uses a lot of abbreviations. Here are descriptions for the ones used in this document:
AAL2 ATM Adaptation Layer 2
ATM Asynchronous Transfer Mode
ETSI European Telecommunications Standards Institute
GSM Global System for Mobile communications
IP Internet Protocol
ISDN Integrated Services Digital Network
Iu Interface between UTRAN and Core Network
IWF Interworking Function (for CS data services)
LI Layer 1
L2R Layer 2 relay protocol
MAC Media Access Control
MSC Mobile Switching Centre
PLMN Public Land Mobile Network
PSTN Public Switched Telephone Network

RAB Radio Access Bearer
RLC Radio Link Control
RLP Radio Link Protocol
UE User Equipment UMSC UMTS Mobile Switching Centre
UMTS Universal Mobile
Telecommunications System
UTRAN UMTS Terrestrial Radio Access
Network
Uu Interface between UTRAN and the
mobile equipment 3GPP Third generation partnership
project created for specifying
the third a third generation
mobile system. More info
available at:
http://www. 3gpp. org/
References: [1] General on Terminal Adaptation Functions (TAF) for
Mobile Stations (MS) (ETSI GSM 07.01).

[2] Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (ETSI GSM 07.02).

[3] Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities (ETSI GSM 07.03).

[4] Radio Link Protocol (RLP) for data and telematic services (ETSI GSM 04.22) [5] ETSI T. doc SMG2 095/99; UMTS
YY. 22
Description of RLC, [6] B-ISDN ATM Adaptation Layer type 2 specification.

ITU-T Recommendation 1.363.2 [7] Segmentation and reassembly service specific convergence sublayer for the AAL
type 2. ITU-T
Recommendation 1.366.1.

UMTS CIRCUIT SWITCHED DATA USER PLANE

Claims of correspondent: **WO 0076138 (A1)**

PATENT CLAIMS 1. Method for communication in an UTRAN, comprising a mobile terminal (MS) working towards a Mobile Switch Centre with an interworking function (IWF), c h a r a c t e r i s e d i n that circuit switched data is transported in upper layers from GSM which uses the protocols RLP and L2R on the transport layers for UTMS speech.

2. Method according to claim 1, c h a r a c t e r i s e d i n that the RLP transport is performed according to GSM 14.4 format.

3. System for communication between a terminal in a wireless access network and a fixed network, c h a r a c t e r i s e d i n: a mobile terminal which runs a Radio Link Protocol (RLP) over Radio Link Control (RLC) * an UMTS terrestial radio access network (UTRAN) adapted to convert the actual radio protocols into Iu protocols an UMTS Mobile Switching Centre (MSC) comprising an interworking function (IWF) adapted to convert the Iu protocols into the protocols used towards the fixed network terminal equipment in the fixed network using GSM upper layer protocols RLP and L2R on standard protocols for UMTS speech for lower layer transport.

4. System as claimed in claim 3, c h a r a c t e r i s e d i n that the UTRAN is adapted to convert the lower layer LI, MAC and RLC protocols into
AAL2 and ATM over Iu.

5. System as claimed in claim a, c h a r a c t e r i s e d i n that said IWF is adapted to convert from GSM V. 110, GSM ATRAU and RLP to ISDN V. 110 and/or modem protocols (LAMPM, V. 34) on the fixed network side.

6. System as claimed in claim 5, c h a r a c t e r i s e d i n that said IWF is adapted to convert from GSM V. 110, GSM ATRAU and RLP to ISDN V. 110 and/or modem protocols (LAMPM, V. 34) on the fixed network side.
